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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.:	10/671,335	Confirmation No.:	5678
Applicant:	Benjamin Chu et al.	Filed:	September 25, 2003
TC/A.U.:	1711	Examiner:	Olga Asinovsky
Title:	Quasi-Interpenetrating Networks Used as Separation Media	Date:	August 26, 2005

Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

DECLARATION UNDER 37 CFR 1.132

I, Dr. Benjamin Chu, state the following:

1. I am one of the inventors for the above-referenced patent application.

2. My curriculum vitae is attached.

3. The present invention includes polymer networks that are useful as separation media for electrophoresis, in particular, capillary electrophoresis. These polymer networks comprise a first polymer, *i.e.*, linear polyacrylamide (LPA) chains or acrylamide/dimethylacrylamide (AM/DMA) random copolymer chains; and a second polymer, *i.e.*, polydimethyl-acrylamide (PDMA) chains, in the form of quasi-interpenetrating networks (quasi-IPNs).

4. The chains of the first polymer and the second polymer interpenetrate one another, and are entangled within one another. However, cross-linking agents are not used in preparation of the quasi-IPNs. Accordingly, there is an insubstantial amount of cross-linking within the quasi-IPNs.

5. Each polymer of the quasi-IPNs provides different desirable properties to separation media. By combining such two different polymers, the quasi-IPNs of the present invention combine the desirable properties of each polymer into one separation medium.

6. For example, the first polymer is hydrophilic, and provides good separation results, such as good resolution, a long read length and a short run time. However, the inability of the first polymer to bind directly to the inner walls of capillary tubes results in an undesirable electro-osmotic flow during electrophoresis.

7. The second polymer is less hydrophilic, and can dynamically coat the capillary inner walls, thus avoiding electro-osmotic flow. Also, the second polymer inhibits the nonspecific adsorption of charged macromolecules by the wall.

8. The quasi-IPNs of the present invention have specific structural properties. For example, the first and second polymer chains within a quasi-IPN are immiscible at least to the point that the polymer chains repel one another. Thus, the chains become extended beyond their normal conformations in solution. Consequently, the quasi-IPNs in solution have a lower weight to volume ratio than the sum of the weight to volume ratios of the constituent polymer chains when not in the form of the quasi-IPNs.

9. The concentration of each polymer in the quasi-IPNs is above its own overlap concentration.

10. The quasi-IPNs of the present invention cannot be prepared by simply dissolving one polymer into another. Instead, the quasi-IPNS of the present invention, must be produced by specific methods.

11. One method by which to produce the quasi-IPNs is by the formation of a polymer network or main frame from the first polymer. Next, the second polymer is polymerized within the main frame.

12. Another method by which to produce the quasi-IPNs is by a solution mixing method. In this method, separate solutions of the first polymer and second polymer are provided. One of these solutions, preferably the PDMA solution, is significantly more dilute than the first polymer solution. The PDMA solution is added to the first polymer solution in a stepwise fashion. After each addition, the resultant solution is thoroughly mixed. This mixing enables the polymer chains to interpenetrate.

13. Voss et al. (U.S. Patent No. 6,706,162) do not disclose the quasi-IPNs of the present invention. Instead, Voss et al. describe the formation of acrylamide polymer above its overlap concentration. Then, a second polymer is simply added to the acrylamide polymer. This second polymer does not polymerize within the acrylamide polymer. The second polymer is simply dispersed among the chains of the acrylamide polymer. As a result, Voss et al. disclose forming a mixture of polymers.

14. The polymer compositions disclosed by Voss et al. have different physical characteristics than the quasi-IPNs. For example, the two different types of polymer chains of the compositions of Voss et al. do not interpenetrate each other.

15. The polymer compositions of Voss et al. do not have the extended formation of the structures of the present invention.

16. The second polymer used in the Voss et al. compositions is below its overlap concentration.

17. A first and second polymer in the form of the quasi-IPNs provide unexpectedly superior separation results vis-à-vis the same first and second polymer in the form described by Voss et al. Due to the more efficient network structure, the quality of separation results is significantly improved. For example, the quasi-IPNs allow for a shorter run time and better resolution than do the compositions of Voss et al. Also, separation media formed from the quasi-IPNs require the use of less polymer material to produce the same mesh size vis-à-vis separation media formed by the Voss et al. compositions.

18. I hereby declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true. Further that these statements were made with the knowledge that willfully false statements, and the like, so made are punishable by fine or imprisonment or both under Section 1001 of Title 18 of the United States Code, and that such willfully false statements may jeopardize the validity of the application of any patent issued thereon.

Ben Chu

Dr. Benjamin Chu

Ben(jamin Thomas Peng-nien) Chu
Curriculum Vitae

Personal Information

Home Address: 27 View Road, Setauket, New York 11733
Nationality: U.S.A.; Naturalized February 13, 1968, U.S. District Court of Kansas City.
Marital Status: Married, three children.

Present Position: Distinguished Professor

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Education:
B.S., magna cum laude, St. Norbert College, 1955
Ph.D., Cornell University, 1959

Employment History:

Research Associate with Peter J. W. Debye, Cornell University	1958-1962.
Assistant Professor of Chemistry, University of Kansas	1962-1965
Associate Professor of Chemistry, University of Kansas	1965-1968
Professor of Chemistry, State University of New York at Stony Brook	1968-1988
Chairman,	1978-1985
Professor of Materials Science and Engineering	1982-
Leading Professor of Chemistry, SUNY/Stony Brook	1988-
Distinguished Professor, SUNY/Stony Brook	1992-

Other Appointments:

Brookhaven National Laboratory	Summer, 1957
Univ. of New South Wales, Australia	Summer, 1974 & 1994
Australian National University	Summer, 1974
Wayne State University, Detroit	May-June, 1975
Hokkaido University, Japan	July-Sept, 1975
Peking University, Fudan University, PR China	August, 1979 & 1982
Institute for Theoretical Physics, Univ. of Calif., Santa Barbara	December, 1982
External Examiner in Chemistry, Chinese University of Hong Kong	1986-1989
Science Advisory Committee, Hong Kong University of Science and Technology	1995-1997
Chinese American Chemical Society, Board of Directors	1995-1997
Member of the St. Norbert College Board of Trustees	2004-

Editorial Boards:

Associate Editor, Materials Letters	1986-1989
Editorial Board, Journal of Colloid and Interface Science	1986-1989
Editorial Advisory Board, Macromolecules	1990-1992
Editorial Board, Review of Scientific Instruments	1993-1995; 2005-2007
Editorial Advisory Board, Journal of Polymer Science Part B (Polymer Physics)	1990-

Fellowships, Special Invitations and Honors:

Participant of the 1966 Study Week on Molecular Forces, Pontifical Academy of Science, Vatican City, Rome, Italy.

Alfred P. Sloan Research Fellow	1966-1968
John Simon Guggenheim Fellow	1968-1969
Visiting Professor, Japan Society for the Promotion of Science (JSPS)	1975-1976, 1992-1993
Humboldt Award for Senior U.S. Scientists	1976-1977, 1992-1993
Distinguished Achievement Award in Natural Science, St. Norbert College	1981
Fellow, American Institute of Chemists	
Fellow, American Physical Society	
Honorary Professor of the Chinese Academy of Sciences	1992-
High Polymer Physics Prize, American Physical Society	1993
Langmuir Distinguished Lecturer Award, Division of Colloid and Surface Chemistry, American Chemical Society	1994
Honorary Professor, Nankai University	1996-
Award for Distinguished Service in Advancement of Polymer Science, Society of Polymer Science, Japan	1997
Honorary Professor, Xiamen University	1998-
1998 Achievement Award of Chinese Institute of Engineers/USA, Outstanding Achievement Award	1998
Honorary Professor, Wuhan University, Wuhan, China	2004-

Lectures:

Robert R. Gilpin Memorial Lecture, Clarkson University,	1996
Collaboratus VI, Distinguished Lectures in Chemical and Biochemical Engineering, Rutgers University,	1996

Research Interests:

Techniques:

Rayleigh, Brillouin and Raman scattering;
Time-resolved small angle x-ray scattering and wide angle x-ray diffraction;
Small angle neutron scattering;
Transient electric birefringence; *Laser-induced fluorescence detection*
Rheometry; *Electrospinning.*

Topics:

Static and dynamical properties of macromolecular, colloidal, and supramolecular solutions,
Nanocomposites; *Biomineralization;*
Polyelectrolyte-surfactant complexes; *Modification of nanostructured materials;*
Supercritical fluids; *Modified fullerenes;*
Capillary electrophoresis of DNA;
Tissue engineering. *Biodegradable polymers for medical applications;*

Publications:

513 scientific papers, 5 book reviews, 6 books, 14 patents, 1 meeting report, 7 article reviews, 18 papers in progress, and 9 patent applications pending.

Consultantships:

1. Calgon Corporation, Subsidiary of Merck & Co., Inc., Pittsburgh, PA.
2. Brookhaven Instruments, Holtsville, New York.
3. Universities Space Research Association (USRA), Microgravity Science & Applications Division, NASA.
4. Eastman Kodak Company, Eastman Chemicals Division, Kingsport, Tennessee.
5. Roche Diagnostic Systems, Division of Hoffmann-LaRoche, Inc., Nutley, New Jersey.
6. Bristol-Myers Squibb Company, The Squibb Institute for Medical Research, New Brunswick, New Jersey.

7. *DuPont Experimental Station, Wilmington, Delaware*
8. W. L. Gore & Associates, Inc., Elkton, Delaware.
9. Dow Chemical Company, Freeport, Texas.

Biographies:

Brief biographies have been listed; for examples, in American Men and Women of Science, *Who's Who in America*, Men of Achievement and *American Catholic Who's Who.*